Questions raised about trace element fluxes in case of regular organic waste application as fertilizing practices: usefulness of a long-term field experiment network

Sabine Houot[a], A. Michaud[a], C. Resseguier[a], D. Montenach[b], T. Morvan[c], F. Feder[d], V. Sappin-Didier[e], F. Watteau[f] and P. Cambier[a]

[a] *UMR ECOSYS, INRA, AgroParisTech, Université Paris-Saclay, France*

[b] *SEAV, INRA, France*

[c] *UMR SAS, INRA, AgroCampus Ouest, France*

[d] *CIRAD, Recyclage et Risques, France*

[e] *UMR ISPA, INRA, Bordeaux Science Agro, France*

[f] *UMR LSE, CNRS, INRA, Université de Lorraine, France*

sabine.houot@inra.fr

Today, the recycling of organic wastes (OW) in agriculture has been largely encouraged since it makes possible to recycle the nutrients they contain as substitute to mineral fertilizers. As an example in 2017, 25%, 54% and 71% of nitrogen, phosphorous and potassium applied on cultivated soils have been applied as organic fertilizers issued from organic wastes, respectively in France. Additionally, the associated input of organic matter could also contribute at increasing soil organic carbon stocks, thus improving soil fertility and potential climate change mitigation. The main sources of organic wastes are of agricultural origin with all animal manures, but also of industrial origin (agro-industries or other) or urban origins (food wastes, green wastes, sewage sludges…). If agricultural and industrial wastes are largely recycled in agriculture, the recycling of urban wastes is strongly encouraged after biological treatments (composting or anaerobic digestion). Finally, urban sewage sludges are also recycled in agriculture in many countries. If these recycling participate to circular economy, such practice needs to be proved to have no adverse impacts on soil, crop and water qualities. The objective is to focus on trace element (TE) contents in these organic fertilizers and the consequences of their repeated application on TE contents in soils, their potential transfers to crops and soil solutions then to food chain and ground waters.

A network of long-term field experiments (SOERE-PRO) have been created among French research institutes, to quantify, explain and be able to predict the consequences of repeated fertilization with OW on soil and water qualities and on crop production and quality. The SOERE-PRO included different pedoclimatic conditions including temperate and tropical conditions, various OW including animal manures and slurries, sewage sludge composted or not, biowast composts and digestates… with some experiments as old as 1998.

TE bioavailability for crops and mobility in soils depend on their speciation in OW and soils but also on soil characteristics such as pH and soil organic matter content or dissolved organic matter content in soil solution. The SOERE-PRO will be presented, and also examples of results of TE mass balance, interactions between impacts (pH and TE mobility for example), soil biological activities, evolution of TE contents in soil, crop and water since 20 years. Finally, questions will be asked from the end-user and agronomist point of vue on the development of pertinent risk indicators.